GLOMECTOMY IN THE TREATMENT OF BRONCHIAL ASTHMA

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Regardless of substantial progress made in the therapy of bronchial asthma, particularly after the introduction of corticosteroids and antihistamine preparations, the results hitherto attained are unsatisfactory, especially insofar complete healing effect is concerned. The search for new therapeutical means continues. Treatment by extirpation of the glomus caroticum (GC) was proposed by N. Nakajama (7) as early as in 1946. More recent publications by E. Planger, W. Ritz, H. Saner, W. Zuzlawski, P. Ganz and others corroborate the prospects of a similar intervention. With its safe and definitely favourable results it replaces all hitherto known surgical methods for the treatment of bronchial asthma as ganglium stellatum blockade, ganglium stellatum extirpation, transthoracic sympathectomy etc.

Substantiation

The carotid glomus is made up of two corpuscles, most frequently situated at the bifurcation of the a. carotis comm. or a. carotis ext. in the vicinity of the point of a. thyreoidea sup. separation. They are enveloped in the a. carotis adventitia and their size measures 2—3 mm.

They have many-sided functions, the most important being:

1. They give impulses regulating the breathing by way of reflexes up to the medulla oblongata. These impulses arise under the effect of certain chemical substances in the blood.
2. Impulses regulating cardiac contractions and blood pressure.
3. Exerting effect on the dilatation of brain vessels.
4. Impulses bringing about erythrocyte level increase in the blood during hypoxia.
5. Effect exerted upon some endocrine glands as adrenals.
6. Effect exerted on the tone of the diaphragm.
7. Effect exerted on certain pathological reflexes.

The operative intervention accounts for interruption of the effect exerted by the impulses upon the respiratory center. The corpuscles do not regenerate.

With the present work we assumed the task to trace the therapeutical effect of the operation.

Technique (after K. Nakajama). Under 0.50% novocain anesthesia and following premedication with lidol and atropine, a rightside skin incision was made running along the anteior margin of m. sternocleidomastoideus; the latter approach is accepted by most of the authors as more easily accessible and furthermore, providing for comparative evaluation of the results.

Access to the bifurcation was gained in acute or blunt fashion. Ligature of v. facialis was often necessary. The separation of the adventitia was carried out 2 cm beneath and 1 cm above the bifurcation. The extirpated material was invariably subjected to histologic control examinations. The patients were discharged on the sixth postoperative day, in the average. Depending on the time the operation was performed, postoperative follow-up periods ranged from 1 month to $1^1/_2$ years. Three of the patients were lost for the dynamic follow-up study. Recordings were made of all indices listed below: subjective complaints, objective physical findings, lung and heart fluoroscopy, RR, ECG, erythrocyte sedimentation rate, whole blood picture, respiratory tests: rate of respiration, tidal air, inspiratory and expiratory volumes, vital capacity (V. C.) (single and cumulative) in comparison also to the theoretical V. C., minute volume, maximum respiratory volume and apneic pause. Additional investigations were performed if needed.

The patients were prepared for operation in order to provide for optimal conditions for surgery. Antispastic means were administered in frequent attacks, whereas corticosteroids and antihistamine preparations — in case of need. If evidence was present for cor pulmonale, the patient was prepared with strophantin. Antibiotic cure + expectorants were prescribed in instances of abundant expectoration or increased erythrocyte sedimentation rate, not infrequently continued also postoperatively until maximum effect was achieved.

Material. A series of 20 patients (15 female and 5 male) underwent operation. Age: 10 to 20 years — one, 21—30 years — two, 31—40 years — four, 41—50 years — six and 51—60 — seven. They had different professions, but most of them (seven) were unspecialized farm workers.

The onset of bronchial asthma usually lacked clearcut provocative agent. In one patient, according to past history data, blooming lime and acacia trees were the primary allergen, in another — flour dust. In one female patient the attacks began immediately after abortion. In 5 patients the onset was characterized by exacerbated chronic bronchitis and in 1 — after pneumonia; hence, in one third of the patients the infectious factor was the most verisimilar sensibilization moment.

The duration of the disease ranged from 1 to 5 years — 12 patients, 6—3 in three, 10—12 in three and 20—33 years — in two. Only patients were operated upon in which the various methods of treatment applied have failed, namely: corticosteoids, antihistamines, antibiotics, other desensibilization therapies, balneo- and climatotherapy, apparatus physiotherapy.

Concomitany affections and complications, often more than one in a single case, were observed in one part of the patients. Their incidence for the total series was the following: chronic bronchitis — 5, emphysema of the lungs — 13 (that is, in the majority), cor pulmonale — 9 (with compensation in 6, H_1 in 2 and H_2 — in one). Hypertonic disease was established in four cases (stage I—1 and stage II—3). Two patients exhibited pronounced neurasthenic syndrome. Climax in moderately severe form was noted in two of the female patients.

The following electrocardiographic pathologic deviations were furthermore established: right femural block — in 1, partial right femural block — 2, „cor pulmonale" — 2, hypoxia of the myocardium evidence — 4 (ST low-

ered beneath 2 mm and T lowered, isoelectrically and negatively in several leads).

The heart rate in most of them was within the limits of normal. Tachycardia ranging from 100 to 200 per min was disclosed merely in 5 patients preoperatively.

The blood pressure was normal with the exception of four patients with accompanying hypertonic disease.

An increase exceeding 4% of the eosinophil cells in the differential blood picture was recorded merely in four patients preoperatively. In one patenit the segmented cells were 17%, with 12 000 leukocytes in 1 mm^3.

Speeded up erythrocyte sedimentation rate was recorded in nine patients, in some of them reaching 85/110, after Westergreen.

In 14 of the series, pathological values were registered of the respiratory tests, performed during free of attacks period, prior to operation.

Results. The operative intervention was tolerated very well by all patients, including those with stage II heart insufficiency. There were no complications on behalf of the respiratory system and heart. Occasionally, the favourable effect of the improved breathing was manifested immediately after the operation.

The complications observed were: rightside Claude—Bernard—Horner syndrome was established in two patients, in one of them — permanent and scarcely outlined. In one female patient hemorrhage from a branch of the a. carotis ext. occurred, intraoperationem, which was very difficult to stop with ligature.

The patients were distributed into three groups according to results actually available (Table 1):

Table 1

Free of Attacks	Improved	Without Effect
9	9	2

One group was designated with the heading "Free of Attacks" since the follow-up term is too short to warrant a definitive conclusion whether or not a full healing is concerned. There were no patients with deterioration of the condition as compared to that prior to operation.

Two patients were included in the "Without Effect" column since they did not show improvement whatsoever at the last two consecutive check-ups; they were in the same condition as before the operation. However, one of them was free of paroxysmal attacks for 5 months postoperatively, whilst the other one — for several weeks.

Under the heading "Improved" all patients were classified which were without attacks postoperatively for e period ranging from 3 days to 9 months (2—4 weeks in the average). Following this period of improvement, they sustained rarer, rather slight and more susceptible to therapeutic influence attacks, which however, resisted the combined treatment aimed at achieving a secondary, permanent, free of attacks effect. Individual therapy was likewise resorted to — usually antispastic means (antiasthmin, novphilin), optimal corticosteroid doses, antibiotic therapy (in instances of bron-

chitis) for suppression of eventual sensibilizing bacterial flora. Occasio nally, antihistamine preparations were also administered, substituted i case of need by their various brands.

Asthma occurred in one of the patients from the column "Free of Attacks on the 10th postoperative day and lasted up to the 50th day despite th high dehydrocortisone doses resorted to (beginning with 10 tablets and gra dually reaching 3 tablets of maintaining therapy). On the 50th day th breathing got normalized and several months thereafter he was free o attacks.

In another patient of the same group, attacks occurred on the second pos operative day. Dehydrocortisone was applied with 8 tablets initial dos Initially, subsequent to the corticosteroid application, the attacks wer interrupted or became milder and within 45 days they disappeared compl tely; after suspending the treatment, the patient had no complaints wha soever over a period of several months. This is demonstrated by the resul of the complex treatment, i. e. the supplementation of drug therapy wit altered reactivity in evidence for exacerbation often yields a favourable e fect, scarcely observed before the operation.

The postoperative changes disprayed by the respiratory tests for the en tire series are:

1. The tidal air exhibited an average increase amounting to 130 mm fo the entire group, with $\sigma = 21.84$, $m = 6.06$ and reliability 8.5.

2. The changes in the rate of breathing accounted for a mean increas of the minute volume, amounting to 800 mm for the total group.

3. The inspiratory volume was improved in some patients up to 40%, i. e with 500—600 ml, but statistically reliable changes were not establishe insofar the total group was concerned.

4. Essential differences in the expiratory volume were not established.

5. The total vital capacity (resulting from the respiratory volume + in spiratory reserve volume + expiratory reserve volume, measured separa tely) displayed an average 210 ml increase for the total group, mainly a the expence of the respiratory volume, but without statistically proved re gularity. The total vital caracity corresponded to the theoretical vital ca pacity merely in 7 patients, whereas in 6 of the patients it displayed a re duction exceeding 40%. In most cases of the latter group, postoperatively rather mild asthmatic attacks persisted accompanied by emphysema mani festations which means that a lesser effect was concerned. An exception i this respect was a female patient displaying 52% reduction of vital capa city with cessation of the attacks postoperatively.

In 5 out of 7 patients with normal vital capacity the postoperative attack were more frequent whereas in 2 — of slighter degree; thus the assumptio is reached that the results obtained are more favourable in instances of nor mal vital capacity.

6. The vital capacity measured a single time postoperatively displaye an increase amounting to 180 ml.

7. The statistical elaboration of the data for the entire series did no reveal improvement of the maximal minute ventilation. Anyway, in in dividual cases its increase amounted to one third of the preoperative value

8. The Stange's test (3) for investigating the apneic pause was the mos indicative of all respiratory examinations performed. It provided mor

reliable data during breathing outside the apparatus. Regardless of the latter finding a regularity of the statistical reliability was not obtained (the essential index was not ≥ 3). However, in all patients exhibiting improved test indices, a clinical improvement was also present and vice versa, in examinations during periods free of attacks. In some patients the increase of the apneic pause lasted from 15 to 35 seconds

The data of the physical investigation of the lungs were usually in accord ance with the subjective complaints of the patients. In some of them anyway, a rise of the asthmatic threshold was established — it is probable that the patient did not complain of asthma, but, during the auscultation prolonged expiration and altered vesicular breathing with wheezing rales were established which was a condition, quite different from the breathing in the periods free of bronchial spasm or subsequent to the application of antispastic drugs, for instance asthmofisin.

The blood pressure was not influenced: the values prior to and after the operation were equal. This holds true also for the patients with hypertension, stage I and II.

In one patient with cor pulmonare, the heart rate after the operation was accelerated from 120 to 140 beats but it regained normal values subsequent to strophantin treatment. During the first postoperative week tachycardia occurred in other three patients (up to 100). The heart rate got normalized after the operation in two patients with tachycardia exceeding 100 prior to the intervention. This is an indication about the possible fluctuations of the heart rate in some patients (about $\pm$ m 20), which usually gets normalized within the first week.

The follow-up of the eosinophilia did not reveal permanent changes — a phenomenon indepentent of the clinical state. There were patients which were free of attacks postoperatively over a period of several months and yet, with eosinophilia up to 8 per cent. It should be therefore assumed that the allergic adjustment persists (remains intact).

The results of the patho-anatomical investigations* of the material extirpated are classified into three groups: 1) with established nerve endings, characteristic of GC; 2) with nerve tissue fibers and 3) without nerve tissue elements. The clinical results, compared to the patho-anatomical findings are illustrated in table 2:

Table 2

Patho-anatomical groups	Groups I	According to II	Clinical Results III	Total
1	6	2	1	9
2	2	6	1	9
3	1	1	—	2
Total	9	9	2	20

* We are indebted to the Chair of Pathological Anatomy for the histological preparations.

Serial novocain blocks in the area of GC were resorted to, without any effect, to the end of elucidating the mechanism of action of the surgical removal of the carotid glomus

As an example of surgical influence exerted on a patient with bronchial asthma, we present the case history of Y. K. A., 13-year-old — after falling ill with chronic bronchitis, the bronchial asthma attacks gradually intensified and became more frequent. One year prior to operation he was treated at the Pediatric clinic — ISUL and discharged with maintaining therapy — one tablet dehydrocortisone daily. In the course of one year he gained weight (from 35 to 51 kg). Prior to admission he had asthma attacks each night. Expectoration — profuse. Objectively — increased subcutaneous adipose tissue, moonlike face, hypersonorous pulmonary sound, vesicular breathing with prolonged expiration and single dry rales. The respiratory tests revealed pathologically reduced expiration and apneic pause 22 sec. ECG with q^R V_1 at R = 10 mm, i. e. evidence for right ventricular hypertrophy and sinus tachycardia — 110 per minute.

Diagnosis: bronchial asthma, chronic bronchitis, initial pulmonary emphysema and cor pulmonale — compensated, steroid cushingoid condition.

Discussion. It is obvious from the data herein reported that during the postoperative follow-up period, good results were recorded in most of the patients — a finding corroborating the effect as described by N. Vasilev and assoc. (2) Merely 10% of the cases described by the latter author failed to achieve an improvement. K. Nakajama (7) claims complete healing or good results in 72.6% of his patients two years after the operation. Moreover, emphasis should be placed on the significance of the complex treatment resorted to in the preoperative preparation of the patients and in the postoperative period as well; it accounts for a rise of the good results' percentual. We haven't come across publications on the complex treatment in cases displaying insufficient postoperative effect. The chronic bronchitis infectious allergy seems the most probable in a great percentage and hence, a continuous treatment is deemed mandatory. It is recommended that these patients be subjected to dispanserization early in the postoperative period.

The value of the method is greatly increased when the results obtained in patients, hardly lending themselves to other type of therapy, are considered. The major effect exerted upon patients with initial respiratory tests, showing values near the normal, justifies the anticipation of a still more successful outcome in early bronchial asthma. The findings just referred to warrant the recommendation of the operative method of treatment for more widespread application. The useless postponing of the operation creates conditions favouring a limited future effect, lost time for the patient and furthermore obviates the prevention of the development of emphysema and cor pulmonale with all possible sequelae. The presence of heart decompensation, femoral block, hypertension and tachycardia by no means constitute a contraindication, provided adequate preparation was performed.

No interrelationship was established whatsoever between the age and the operative outcome. Thirteen of the patients were in the 40—60 years age-group. They tolerated the operation very well which is in compliance with literature reports (5). The apneic pause, tidal air and vital capacity proved to be the most easily accessible indices of the respiratory tests for dynamic tracing.

Precision and atraumatism are essential in avoiding complications as well as in reducing the possibility for vessel rupture or Claude—Bernard—Horner syndrome occurrence.

The comparative study of the clinical and pathologo-anatomical results after extirpation warrants the assumption that the removal of the adventitia or sectioning of the nerve fibers might be eventually considered the only important steps in cases with good results. On the other hand, the possibility for GC extirpation without cessation of the attacks (or merely reducing their intensity) is explained with the complexity and heterogeneity of etiopathogenetic factors in the affection — a fact stressed by others too (5). Nevertheless, a parallelism up to a certain degree is observed between the clinical and pathoanatomical results. It is quite possible that in some cases the removal of the GC is bit partial and thus, it is strongly recommended to carry out pathoanatomical investigations of the material in all instances since it might greatly facilitate the consideration of the problem of bilateral glomectomy in case of therapeutic failure.

Inferences

1. The wider application of glomectomy for the treatment of bronchial asthma is advocated, possibly in the early stages of the disease.
2. In instances of partial effect, better postoperative results will be achieved if a combination with conservative methods is resorted to.
3. The results herein reported are obtained in patients in which the previous treatment with various methods failed.
4. The concomitant hypertension, pulmonary emphysema, cardiac block and tachycardia are not contra-indications for the application of the operation, provided adequate measures are provided for in case fo need.
5. Postoperative complications in the various systems of the organism were not established and the operation might be considered innocuous.

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ЛЕЧЕНИЕ БРОНХИАЛЬНОЙ АСТМЫ ГЛОМЭКТОМИЕЙ

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РЕЗЮМЕ

Проведена гломэктомия с правой сторсны у 20 больных бронхиальной астмой, у которых результаты консервативных методов лечения были неудоволетворительными. В случае необходимости послеоперативно применяется комбинированная терапия, благодаря чему достигаются еше более хорошие результаты. Больные прослежены в течение 1 месяца до $1^1/_2$ лет. За этот период у 9 нет приступов, у 9 они боле стабые и у 2 нет эффекта. Метод рекомендуется внедрить более широко.